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71

Linking green entrepreneurial orientation and ambidextrous green innovation to stimulate green performance: a moderated mediation approach

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Abstract

Purpose – In view of the significance of intangible organizational resources and firm sustainability, this study investigates the mediating role of ambidextrous green innovation and the moderating effects of resource orchestration capability in the relationship between green entrepreneurial orientation and green performance.

Design/methodology/approach – The research employed a quantitative analysis technique using hierarchical linear regression and a moderated mediation approach on a sample of 409 managers from UAE manufacturing firms to investigate the proposed relationships among the variables.

Findings – The research results show that a firm's green performance is influenced by its green entrepreneurial orientation. Green innovation, both exploratory and exploitative, mediates the link between green entrepreneurial orientation and green performance. Moreover, the association between green entrepreneurial orientation and exploitative green innovation, as well as between exploitative green innovation and a firm's green performance, is strengthened by resource orchestration capability. The findings of the moderated mediation show that when resource orchestration capacity is high, exploitative green innovation has a greater mediating effect on green entrepreneurial orientation and green performance.

Practical implications – This study provides valuable insights for manufacturing firms to achieve sustainable performance and reduce their environmental impact. Firms should adopt proactive environmental strategies and innovative approaches to achieve sustainable green performance by adopting green entrepreneurship and establishing ambidextrous green innovation.

Originality/value – This study contributes to the literature on GEO, ambidextrous green innovation, resource orchestration capability, and green performance. These results provide insight into fostering green innovation in the manufacturing industry, deepen the theoretical foundation for green entrepreneurship, and advance the field of green entrepreneurship study.

Keywords Green entrepreneurial orientation, Exploitative green innovation, Exploratory green innovation, Green performance, Resource orchestration capability

Paper type Research paper

1. Introduction

In recent decades, there has been growing recognition of the difficulties surrounding organizations' long-term growth and corporate sustainability practices. The necessity for environmental conservation management has grown incredibly quickly, and green management has evolved as an essential tool for businesses. The manufacturing sector cannot be excluded from these environmentally conscious movements. This economic sector must acknowledge its role in accelerating environmental decline and amplifying climate

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change's effects (Ali *et al.*, 2021). Compared to other industries, manufacturing firms are often regarded as one of the least eco-sustainable globally (Shehzad *et al.*, 2023b). While organizations commonly prioritize environmental sustainability, the relationship between preserving the environment and industrial strategy has traditionally been viewed as a trade-off involving environmentally responsible practices and financial profitability (Wang and Juo, 2021). Manufacturers have recognized the necessity of effectively managing this apparent trade-off between ecological sustainability and financial success (Sahoo *et al.*, 2022). As a result, improving sustainable business operations and practices in manufacturing firms is the most effective strategy to assist firms in upholding social responsibilities, achieving economic success, and reconciling environmental preservation and financial performance.

The significance of green performance (GP) for manufacturing firms transcends immediate environmental benefits, serving as a cornerstone for long-term sustainability and competitiveness. Emphasizing GP positions firms to address stringent environmental regulations effectively, reducing legal and financial risks (Abbas and Khan, 2022). It aligns with the increasing consumer preference for sustainable products, enhancing market competitiveness (Wang and Juo, 2021). Additionally, green practices drive operational efficiencies, leading to significant cost reductions and spur green innovation (GI) (Shehzad *et al.*, 2023a), unlocking new growth avenues. Strong GP also improves investment attractiveness by fulfilling environmental, social, and governance criteria (Abbas, 2020), ensures long-term viability amidst finite natural resources (Muisyo and Qin, 2021), and boosts employee engagement and talent attraction with its commitment to environmental stewardship (Sharma *et al.*, 2021). Thus, GP is not merely about environmental responsibility but a strategic imperative for manufacturing firms navigating the complex landscape of global sustainability challenges. Therefore, boosting GP for manufacturing firms is necessary to balance environmental performance and economic development, and there is a dearth of research on this area (Úbeda-García *et al.*, 2022; Wang and Juo, 2021). The area of research stands out as distinct, engaging, and worthy of investigation for several key reasons.

First, Recent literature underscores the critical role of green entrepreneurial orientation (GEO) in mitigating environmental impact and enhancing eco-innovation (Shehzad *et al.*, 2023b; Jiang *et al.*, 2018). Despite GEO's proven benefits for creating sustainable products and services (Dean and McMullen, 2007) and its positive influence on environmental performance (Jiang *et al.*, 2018; Wang *et al.*, 2023; Shehzad *et al.*, 2022c; Makhloufi *et al.*, 2022), the explicit effect of GEO on firms' green performance (GP) remains insufficiently explored. Although researchers have investigated the GEO as a catalyst for various aspects of firm performance, such as environmental and financial performance (Jiang *et al.*, 2018), sustainable firm performance (Habib *et al.*, 2020), firm performance (Majali *et al.*, 2022), and environmental performance (Frare and Beuren, 2022). Particularly how GEO drives firms to decide to adopt green practices and technologies, has not been adequately addressed. This oversight presents a significant research gap, indicating a pressing need to elucidate the direct relationship between GEO and GP to better understand how entrepreneurial orientation towards sustainability can influence environmental strategies and outcomes.

Second, heightened environmental concerns have underscored the need for businesses to bolster their GI capabilities, aiming to mitigate their ecological footprint and enhance sustainability (Shehzad *et al.*, 2023a; Safari *et al.*, 2020). GI is instrumental in developing new or improved products and processes that minimize environmental damage and promote sustainability across the ecosystem, industries, and society (Al Mamun *et al.*, 2018; Makhloufi, 2024; Sellitto *et al.*, 2020). It enables the exploration of renewable energy, efficient resource use, the creation of eco-friendlier products, and the development of solutions beneficial for both the environment and businesses (Frare and Beuren, 2022; Wang *et al.*, 2020b). GI also provides innovative avenues for companies to engage in green activities and improve their

GP (Shehzad *et al.*, 2023a). The significance of GI in linking GEO, GI, and firm performance has gained recognition (Frare and Beuren, 2022; Wang *et al.*, 2023; Shehzad *et al.*, 2022c); however, the influence of GEO on GP through ambidextrous GI remains under-researched. Despite acknowledging GEO's role in promoting sustainability and sustainable performance, empirical studies exploring how GEO interacts with ambidextrous GI to boost GP are scarce, highlighting a research gap in understanding the impact of ambidextrous GI on the GEO-GP relationship and stressing the need for further exploration.

Finally, Resource orchestration capability (ROC) is one of the most important organizational abilities that moderate GI (Wang *et al.*, 2020b) and the firm's GP by helping to coordinate resources, such as financial resources, human resources, knowledge, technology, and other inputs that are required for the successful implementation of green initiatives (Shehzad *et al.*, 2023b). Organizations with orchestration capabilities are better equipped to determine where their resources are needed to impact their environmental performance targets most. By properly organizing resources, businesses may capitalize on their core competencies, get access to new sources of information, and develop creative, sustainable solutions (Xin *et al.*, 2022). Besides this, ROC may aid in ensuring the longevity of green initiatives by allowing businesses to monitor their development and reallocate assets when necessary. Among the many organizational competencies, ROC is crucial for decreasing conflict and enhancing resource assimilation in the company, as well as a dynamic ability for assisting companies in changing knowledge to promote GI (Albort-Morant *et al.*, 2018) and promoting firms' GP. With the emergence of environmental concerns and attempts to stimulate GI and businesses' GP, it is unclear how company capabilities such as ROC regulate ambidextrous GI and firms' GP (Wang *et al.*, 2020b; Shehzad *et al.*, 2023b). Arguably, firms good at structuring, bundling, and leveraging the resources portfolio may benefit more from the GEO for ambidextrous GI and firms' GP. Thus, this research investigates the degree to which ROC moderates the relationship between GEO, ambidextrous GI, and the firm's GP.

Based on the above discussion, the current study aims to answer the following questions:

RQ1. Does GEO significantly impact a firm's GP?

RQ2. Does ambidextrous GI mediate the relationship between GEO and the firm's GP?

RQ3. Does ROC moderate the relationship among GEO, ambidextrous GI, and the Firm's GP?

The current study intends to bridge this knowledge gap by establishing a connection between GEO and GP of the manufacturing industry. Moreover, there are insufficient studies in the manufacturing industry investigating how GEO and organizational green ambidexterity affect corporate GP. Moreover, the ability to coordinate resources is provided to control how GEO, ambidextrous GI, and GP interact with one another. In addition to filling a gap in the body of knowledge about the link between GEO, ambidextrous GI, and GP, the present research will also provide managers in the manufacturing sectors helpful insights into how to use GEO and ambidextrous GI to accomplish green development goals.

2. Literature review

2.1 Theoretical underpinnings

From the perspective of the Natural Resource-Based View (NRBV) theory, the relationship between GEO, GI, and GP is closely interconnected, highlighting how companies can achieve sustainable competitive advantage by incorporating environmental management and innovation into their strategies. According to NRBV, the strategic management of resources

with a focus on environmental stewardship not only reduces risks but also uncovers new opportunities for value creation (Hart, 1995). In the context of NRBV, GEO represents a firm's inclination towards embracing environmental sustainability as a crucial aspect of its entrepreneurial endeavors. This orientation prepares the organization to seek out, recognize, and exploit opportunities for environmental innovation. GEO drives the pursuit of GI, indicating that a proactive, innovative, and risk-managing approach towards environmental challenges directly affects the type and rate of green innovations a firm undertakes (Makhloufi *et al.*, 2022; Shehzad *et al.*, 2023b). In essence, GEO serves as the strategic mindset that propels a firm towards developing new or improved eco-friendly products, services, processes, and technologies—characteristics of GI (Makhloufi *et al.*, 2021).

The association between GI and GP emphasizes the conversion of environmental sustainability efforts into concrete outcomes (Shehzad *et al.*, 2023a). GI represents the tangible actions and results stemming from GEO, which illustrates a company's dedication to environmental stewardship through new products, processes, and practices (Asiaei *et al.*, 2022). This innovative push towards sustainability directly contributes to improving GP, which includes both environmental advantages like reduced waste and emissions, as well as economic gains such as cost savings, revenue growth from eco-friendly products, and enhanced market competitiveness (Zhang *et al.*, 2018). GI acts as a critical link between GEO and GP, translating a company's green entrepreneurial aspirations into measurable environmental and economic achievements (Wang *et al.*, 2023). Within the NRBV framework, the interdependence between GEO, GI, and GP forms a strategic loop where each element strengthens and supports the others. GEO drives GI, which in turn enhances GP. This reinforced GP then feeds back to encourage the company's commitment to GEO, fostering a culture of continuous environmental innovation and advancement (Ullah and Qaiser Danish, 2020). Additionally, the positive feedback from successful GP can further stimulate the company's green entrepreneurial orientation, creating a virtuous cycle of sustainable development (Shehzad *et al.*, 2023b).

Based on NRBV theory, the current study proposes a positive relationship between GEO and corporate GP. Moreover, GEO and GP association is mediated by two facets of ambidextrous GI, exploitative and exploratory GI, and moderated by the capability to orchestrate resources. The research model is shown in Figure 1.

2.2 Green performance

The enhancement of green/environmental performance would arise from implementing green practices (Zhu and Sarkis, 2004). GP highlights the firm's environmental activity's effectiveness and efficiency by giving crucial information on environmental consequences,

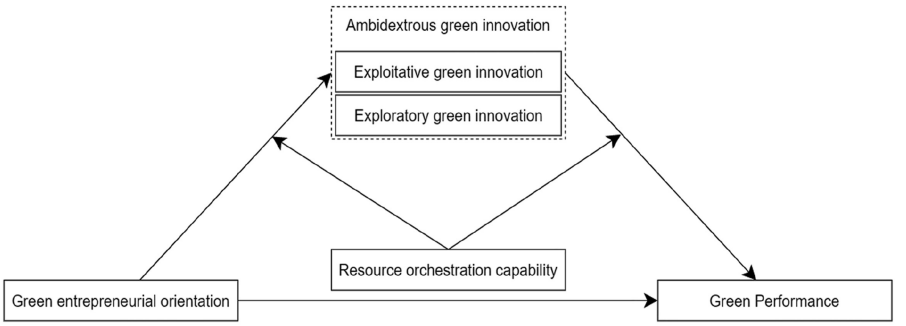


Figure 1.
Research framework

Source(s): Created by author

compliance with regulations, and organizational procedures (Neely *et al.*, 1995). To minimize the negative environmental effects of a company's activities, such as energy and water usage, material waste, and contamination of the environment, green performance entails optimizing processes and resources (Abbas, 2020). Lowering operating costs, boosting efficiency, enhancing brand and customer loyalty, and meeting and surpassing regulatory criteria may help businesses acquire a competitive edge (Sharma *et al.*, 2021). By lowering emissions, preserving natural resources, and minimizing waste, GP assists businesses in improving their environmental performance. Lowering manufacturing costs and their environmental impact also enables businesses to obtain a competitive edge (Wang and Juo, 2021). Businesses that commit to sustainability might also get more devoted customers and a stronger brand reputation. Consistent with previous research, we defined GP as the extent to which a company's operations are environmentally friendly (Pipatprapa *et al.*, 2017).

2.3 Green entrepreneurial orientation

Entrepreneurs in the environmental industry aim to promote sustainable development and reduce pollution by implementing environmentally friendly practices. GEO plays a crucial role in fostering an organization's GI competence. Businesses that prioritize environmental sustainability use green raw materials, technology, and waste reduction methods to mitigate the negative effects of their activities on the environment (Rehman *et al.*, 2021; Shehzad *et al.*, 2022a). Firms take advantage of new technology and innovative approaches to increase the efficiency of natural resources and energy (York *et al.*, 2016; Alam *et al.*, 2024). According to Kraus *et al.* (2018), adopting a green entrepreneurial approach can improve organizational performance by enhancing the firm's ability to identify and seize new opportunities. GEO-oriented organizations follow environmental regulations and participate in novel and often risky initiatives to address the environmental concerns of various stakeholders (Jiang *et al.*, 2018; Makhloufi *et al.*, 2024a). A green entrepreneurial approach is seen as a proactive strategy that enables firms to continuously improve their performance and embrace new opportunities (Zahoor and Gerged, 2021). In line with earlier research (Jiang *et al.*, 2018; Shehzad *et al.*, 2022c, b), we define GEO as the structures, processes, and behaviors of companies that demonstrate green innovativeness, proactivity, and risk-taking, resulting in sustainable decisions and activities that improve the environmental performance of enterprises.

2.4 Ambidextrous green innovation

GI can contribute to sustainable growth by introducing new products, processes, and services that mitigate the negative impact of traditional business practices on the environment and natural resources. According to Borghesi *et al.* (2015), GI can enhance business efficiency and competitiveness by producing eco-friendly products, improving processes, and increasing organizational effectiveness. GI can be achieved through various green initiatives, such as adopting renewable energy sources, implementing efficient industrial methods, and promoting sustainable goods and services (Shehzad *et al.*, 2022c). Such initiatives can provide a competitive edge, increase customer satisfaction, and reduce operational costs (Abbas and Sağsan, 2019). Previous research has categorized GI into different types, including green process innovation and green product innovation (Xie *et al.*, 2019), green radical and incremental innovation (Chen *et al.*, 2014), green technology innovation (Butt, 2016), and green management innovation (Li *et al.*, 2018). To generate value in today's environmentally conscious world, organizations must consistently develop and implement GI strategies that prioritize energy conservation and ecological sustainability (Wang *et al.*, 2023). Moreover, ambidextrous GI, which combines exploratory and exploitative innovations, can help organizations address environmental problems while strengthening existing skills and

gaining a competitive edge (Shehzad *et al.*, 2023b; Wang *et al.*, 2020b). Based on an extensive literature review and following the recent studies of Shehzad *et al.* (2023b) and Úbeda-García *et al.* (2022), we categorize ambidextrous GI in exploitative and exploratory GI. Chen *et al.* (2014) asserts that "exploitative GI is the use of current environmental knowledge, skills, and processes to improve green goods and designs, while exploratory GI is the use of new environmental information, technical skills, and skills to create new green markets and green products."

2.5 Resource orchestration capability

Resource orchestration refers to managing the effective and sustainable use of available resources. The resource orchestration approach, which has attracted a lot of interest in recent years, is a prospective topic of study to investigate how firms could manage their resources for successful competitive effectiveness (Wang *et al.*, 2020b; Teece, 2012; Shehzad *et al.*, 2023b). It entails automating procedures to decrease energy and water use and waste and enhance efficiency (Wales *et al.*, 2013). The literature shows that a stronger ROC is crucial for enhancing innovation while adjusting to shifting market circumstances (Wales *et al.*, 2013; Wong *et al.*, 2018). For instance, Teece (2012) stresses the importance of resource orchestration in reducing internal friction and enhancing resource interconnections inside the company, supporting the dynamic capacities required to promote green initiatives (Wang *et al.*, 2020b). Literature highlights that having resources is insufficient to remain ahead of the competitors (Sirmon *et al.*, 2011), and having valued and constrained resources is a required but inadequate prerequisite for being competitive: Resources must also be effectively managed to give modulatory advantages (Hitt, 2011). The paradigm put forward by Sirmon *et al.* (2011) indicates that businesses can only use their resources to the fullest extent and for the greatest value when they are positively utilized alongside competences and managerial acumen. In line with prior research, we characterize ROC as a company's ability to effectively organize, bundle, and exploit its resource portfolio for organizational effectiveness (Shehzad *et al.*, 2023b; Sirmon *et al.*, 2011).

2.6 Green entrepreneurial orientation and green performance

The GEO entails inventiveness, proactivity in the search for viable opportunities, and risk-taking tendencies (Jiang *et al.*, 2018), intending to generate economic and environmental advantages for the company via processes, ecological goods, and operations (Gibbs and O'Neill, 2014). GEO recognizes those possibilities that might be leveraged to decrease environmental deterioration and market failure by enhancing market efficiency. GEO provides Entrepreneurs with specific capabilities that let these businesses investigate, recognize, and evaluate the components directly connected to environmental market inefficiencies (Teece, 2012). The potential that some market failures may result in environmental damage (Jiang *et al.*, 2018) will most likely provide the opportunity for GEO interventions. Typically, firms are criticized for their poor adoption of eco-friendly technologies, which results in the inefficiencies of alternative renewable energy sources (Sine and Lee, 2009). GEO allows businesses to find technology and ways to minimize the negative consequences of current business practices to overcome this market failure, which is strongly related to environmentally relevant deterioration (Makhloufi *et al.*, 2024b). GEO helps businesses to find and create green practices, processes, and technologies in this manner, increasing production efficiency while having no negative influence on the environment (Demirel *et al.*, 2019).

Green entrepreneurial orientation assists firms in enhancing their sustainability goals and performance objectives by facilitating the identification and exploitation of opportunities in green projects (Shehzad *et al.*, 2023b). This approach allows businesses to create

environmentally friendly goods, services, and technology, as well as modify existing ones. Firms with a green entrepreneurial attitude are more likely to experiment with and implement new strategies to reduce their ecological footprint (Wang *et al.*, 2023). For example, they might develop new environmentally friendly materials or processes for production, and invest in renewable energy sources. As a result, a green entrepreneurial orientation can help businesses enhance their environmental performance, leading to a competitive edge Jiang *et al.* (2018). This can involve adopting eco-friendly technology, streamlining processes to be more sustainable, or introducing new products and services that prioritize environmentally friendly procedures and materials. A green entrepreneurial attitude also promotes team creativity and cooperation, leading to innovative, sustainable solutions (Frare and Beuren, 2022). Ultimately, a business with a green entrepreneurial orientation can benefit from reduced environmental impact and increased competitive advantage (Makhloufi *et al.*, 2023). According to Jiang *et al.* (2018), diverse external factors and even the traits of the key managers are partially responsible for the findings that are not definitive about the relationship between entrepreneurial orientation and performance (Cannavale *et al.*, 2020). Despite the established link between GEO and environmental performance, empirical research into the mechanisms by which GEO relates to GP remains limited. Thus, the study proposes the following hypothesis to investigate GEO's effects on GP:

H1. GEO has a significant impact on the firm's GP.

2.7 Mediating role of ambidextrous green innovation

In addition, prior research has shown that a firm may be an ambidextrous organization by seeking out both exploitative and exploratory innovations (Lee *et al.*, 2018) and that such a business is more probable to be successful (Lin and Ho, 2016). Focusing on green ambidexterity, GI is connected to goods, processes, and services to safeguard the environment, a process in which enterprises continually launch and execute green activities engaged in energy savings, pollution avoidance, and environmental development sustainability practices (Chen *et al.*, 2006) to finally gain economic advantages (Chen, 2008). GI also refers to incorporating environmentally friendly technology, procedures, and goods into the current business paradigm. This covers both the development of novel environmentally friendly solutions and the adoption of sustainable behaviors. Various mechanisms exist via which the ambidextrous GI process mediates the connection between green entrepreneurship and environmental performance. Secondly, it promotes the creation of eco-friendly technologies and procedures that are more effective and affordable. Second, it promotes the adoption of environmentally friendly practices inside the company, which may enhance environmental performance. Lastly, it acts as a go-between among environmental stakeholders and the organization, encouraging the sharing of information and resources. Hence, by encouraging green entrepreneurship and enhancing environmental performance, GImay assist firms in becoming more ecologically friendly.

Ambidexterity in GI gives businesses an edge in their capacity to study and utilize their surroundings concurrently, enabling them to combine green entrepreneurial orientation with exceptional green performance (Sharma *et al.*, 2021). To maintain their competitive edge over the long term, businesses must be inclined toward green entrepreneurship (Shehzad *et al.*, 2022c; Frare and Beuren, 2022). Ambidextrous GI allows businesses to generate value by developing new goods, services, and business models that are both environmentally benign and economically viable, mediating the link between green entrepreneurial attitude and environmental performance (Shehzad *et al.*, 2023a). Companies that combine environmentally responsible business practices with innovative strategies often find themselves at the forefront of their field. In this regard, green ambidexterity may be seen as a tool for manufacturing companies to integrate environmental issues into their strategy while also

bolstering their competitive advantage (Chen *et al.*, 2006) by making innovations (radical or incremental) that can have a beneficial effect on their sustainability practices (Calza *et al.*, 2017).

Although the importance of GI in mediating the GEO-environmental performance link has been established, empirical research on how exploitative and exploratory GI mediates the impacts of GEO on GP is still insufficient. Therefore, the following hypotheses are proposed:

H2a. Exploitative GI significantly mediates the relationship between GEO and GP.

H2b. Exploratory GI significantly mediates the relationship between GEO and GP.

2.8 Moderating effects of resource orchestration capability

Both NRBV and the concept of resource orchestration suggest that a company's ability to innovate and remain competitive comes from within (Hart, 1995; Sirmon *et al.*, 2007; Wang *et al.*, 2020b). Therefore, ROC can significantly impact the connection between GEO, GI, and GP. By assisting entrepreneurs in better resource management, ROC may weaken the relationship between green entrepreneurial orientation and green innovation. Greater resource orchestration skills enable entrepreneurs to access, recognize, and employ the right resources more effectively, leading to a higher likelihood of developing novel green solutions and collaborations. This, in turn, can result in the creation, implementation, and oversight of GI programs (Shehzad *et al.*, 2023b). By fostering team cooperation and information exchange, resource orchestration can help entrepreneurs explore new green market opportunities more quickly (Wang *et al.*, 2020b). Additionally, resource orchestration can contribute to the long-term success of green technologies by allowing businesses to measure, monitor, and analyze outcomes over time. Manufacturing companies that operate environmentally conscious are more likely to pursue strategic alliances and collaborations to deal with market instability and ensure significant GI development (Úbeda-García *et al.*, 2022). By strengthening their capacity for resource orchestration, firms can draw in prospective business partners with similar sustainability goals, providing additional skills, information, ambidextrous GI, and resources across their entire processing chain (Wang *et al.*, 2020b). The following hypotheses are derived after an examination of the literature, with an emphasis on the NRBV and resource orchestration capacity.

H3a. ROC moderates the relationship between GEO and exploitative GI.

H3b. ROC moderates the relationship between GEO and exploratory GI.

The capacity to orchestrate resources moderates the link between GI and company environmental sustainability by guaranteeing that assets are managed adequately and productively. Resource orchestration enables organizations to create and deploy GI cost-effectively, reducing ecological impacts and allowing the adoption of green initiatives that enhance overall sustainable development. Resource orchestration capabilities may also pinpoint areas where more eco-friendly expenditures are required, or efficiency gains can be made, improving business sustainability impact. Moreover, improving ROC accelerates the rate at businesses investigate new green market opportunities by employing their capacity for green knowledge management (Sahoo *et al.*, 2022)and improving their ambidextrous GI (Shehzad *et al.*, 2023b) to boost businesses' GP. Also, manufacturing companies that feel pressured to practice environmentally conscious operations are more inclined to look for strategic alliances and collaborations to get around market uncertainties while guaranteeing considerable green improvement (Singh and El-Kassar, 2019).

As a consequence of enhancing resource orchestration capability, firms may attract new business collaborators with similar sustainability objectives who can provide additional capabilities, expertise, and resources across their whole operational process chain (Shehzad

et al., 2023b; Wang *et al.*, 2020b). Resource orchestration capabilities may boost GI in businesses by simplifying procedures, cutting down on resource waste, and generating efficiencies. In terms of emissions, energy usage, and total environmental consequences, these changes may enhance businesses' environmental performance. Resource orchestration capacity promotes a stronger connection between GI and manufacturing companies' gross profit by regulating their interaction, which results in a more sustainable manufacturing industry. Hence, these considerations support the hypothesis that a higher capacity for resource orchestration would help firms enhance GP by stimulating ambidextrous GI.

H4a. ROC moderates the relationship between exploitative GI and GP.

H4b. ROC moderates the relationship between exploratory GI and GP.

2.9 Moderated mediating effect of resource orchestration capability

The literature demonstrates that higher resource orchestration capabilities may allocate and use resources more efficiently in boosting organizations' performance via entrepreneurial activity (Shehzad *et al.*, 2023b; Choi *et al.*, 2020). Organizations with strong resource orchestration capabilities can use a green entrepreneurial orientation to find pertinent environmental information more efficiently from various external, interdisciplinary knowledge sources for innovation to boost their firms' sustainability development (Wang *et al.*, 2020b; Shehzad *et al.*, 2021). In the link between GEO and a business's environmental performance, the ROC of the firm affects the intermediary influence of green innovation. The capacity to identify, acquire, and allocate resources is one of the components of the resource's orchestration capability. Ambidextrous GI may be more successful at reducing their negative effects on the environment and enhancing the efficiency of the company when GEO is paired with strong resource orchestration capabilities (Shehzad *et al.*, 2023b). Based on the abovementioned factors, it is argued that ambidextrous GI mediates between businesses' GEO and GP, and resources orchestration capacity may strengthen these interactions. Thus, the ROC moderates the mediating effects of ambidextrous GI in the relationship between GEO and a firm's GP. Based on the above considerations, this research proposes the following hypotheses.

H5a. The mediating effect of exploitative GI in the relationship between GEO and GP is stronger when ROC is high.

H5b. The mediating effect of exploratory GI in the relationship between GEO and GP is stronger when ROC is high.

3. Research methodology

3.1 Samples

A quantitative research approach is the most appropriate when a study's primary objective is establishing relationships between constructs (Creswell *et al.*, 2003). Since the major purpose of this research is to investigate hypotheses developed from the current theory, a deductive empirical approach is used (Bryman, 2007). To gather data, we employed a questionnaire for surveys on GEO, ambidextrous GI (exploratory and exploitative), GP, and ROC, and the population of interest for this study consists of small and medium-sized enterprises (SMEs) manufacturing in the UAE. The criteria for defining SMEs in the manufacturing sector in the United Arab Emirates (UAE) are outlined in Cabinet Resolution No. 22 of 2016. According to this resolution, small enterprises have a workforce ranging from 10 to 100 individuals and generate an annual revenue of no more than AED 50 million. Medium-sized enterprises, on the other hand, have a workforce of between 101 and 250 individuals and generate annual

revenue of no more than AED 250 million (Singh *et al.*, 2022). The manufacturing sector was selected due to its significant impact on both social and ecological systems, as well as its rapid resource utilization and significant environmental harm. In today's economic transformation, it is crucial for the manufacturing sector, which is known for its substantial energy consumption and environmental pollution (Li and Zhang, 2014), to participate in CSP. Consequently, the research sample for this study comprised manufacturing firms located in the UAE.

To determine the compliance of small and medium-sized enterprises (SMEs) in the manufacturing sector in the UAE with the requirements outlined in UAE Cabinet Resolution No. 22 (2016), we utilized the Yellow Pages search engine at "https://www.yellowpages.ae" between April and June 2023. We randomly selected 289 manufacturing enterprises from the directory for data collection, but only 175 granted us permission to participate in our research. Our research participants were individuals in managerial roles, whom we selected using a non-probabilistic convenience sampling method, as they possess decision-making authority related to strategy. Furthermore, these individuals held critical information and were instrumental in disseminating information across various departments (Shehzad *et al.*, 2023b). In line with previous studies conducted by Abbas and Sağsan (2019) and Ooi (2014), we distributed 627 questionnaires with official authorization to individuals in top, middle, and lower-level management positions, as they were knowledgeable about organizational policies and practices. Data collection was carried out through diverse methods, including online surveys and self-administered techniques. This process yielded 457 returned questionnaires, with 46 of them lacking data or providing inconclusive responses. After eliminating the invalid questionnaires, we obtained 409 valid responses, resulting in a response rate of 63.906%. Table 1 provides detailed information on the demographic characteristics of the respondents.

Characteristics		Frequency	Percent (%)
Respondent_age	18–25 Year	45	11.0
	26–35 Year	184	45.0
	36–45 Year	129	31.5
	>45 Year	51	12.5
	Total	409	100.0
Gender	Male	249	60.9
	Female	160	39.1
	Total	409	100.0
	Male	249	60.9
Position	lower Management	220	53.8
	Middle Management	150	36.7
	Top Management	39	9.5
	Total	409	100.0
Firm size	<100	98	23.96
	100–200	103	25.18
	201–500	97	23.72
	>501	111	27.14
	Total	409	100.00
Firms age	<5 Years	102	24.94
	6–10 Years	108	26.41
	11–20 Years	93	22.74
	>20 years	106	25.92
	Total	409	100.00

Table 1.
Demographic statistics

Source(s): Created by author

To check for non-response bias, an analysis of the distinctions between respondents and non-respondents was then conducted. Based on the control variables, the *t*-test indicated no significant differences (size and age). A comparison was also made between early and late responders regarding demographics and model factors. The lack of differences emerging from these comparisons ($p < 0.05$) demonstrated unequivocally that non-response bias was not a concern.

3.2 Measures

According to Christmann (2000) recommendations, the following three processes were used to create the final questionnaire for this study. After extensively reviewing the relevant literature, we developed scales for all variables. Second, we consulted three experts and updated the measurement scale to make it more transparent and understandable. Finally, the final questionnaire is separated into six sections based on the measurements employed to explain the concepts. The purpose of this study and the terms used in the study are defined in the first section. Participants' demographic information was requested in the second portion of the questionnaire. In the third part, GEO was highlighted using five items adapted from Jiang *et al.* (2018) study to show a firm's strategic orientation toward fostering sustainable development, with "We usually start green initiatives before our competitors" as an example item.

Moreover, eight items were employed in the fourth section to measure ambidextrous GIs (exploratory and exploratory GI) and were investigated using four items each, which were obtained from Wang *et al.* (2020a) and Shehzad *et al.* (2023b) studies. "Our firm actively improves current green products, processes." as a sample item of exploitative GI, and "Our firm actively exploits new green products, processes and services." as a sample item of exploratory GI. Similarly, six questions from studies by Daily *et al.* (2007) and Yu *et al.* (2017) were used to assess green performance in the fifth part; one of the items is "Our firm conforms with requirements of outputs of waste water." In the last section of the questionnaire, the ROC scale consists of three questions drawn from Wang *et al.* (2020b) and Shehzad *et al.* (2023b) and a sample item: "our firm can integrate all kinds of knowledge resources" Table 3 contains the questionnaire.

A pilot test was also conducted to assess the validity and reliability of the measures used. The pilot survey's constructs were all internally consistent, with estimates ranging from 0.74 to 0.87, satisfying Hair *et al.* (2010) criteria of >0.7. This led the researchers to begin their in-depth assessment. Additionally, following the prior studies of Shehzad *et al.* (2023b) and Abbas and Sağsan (2019), we also accounted for key control factors including firm size and age, to rule out any conceivable alternative explanations for the associations established by the theoretical Model. The average number of workers determined the size of the firms and the age of the firms were determined by the years.

3.3 Common method bias

Our research may be affected by common method bias due to our focus on data from individual participants. To address this issue, we took three steps. Firstly, we randomized the order of the questionnaire items and promised anonymity to the respondents to encourage truthful feedback (Shehzad *et al.*, 2022b). Secondly, we applied Harman's single-factor test based on Podsakoff *et al.* (2003) recommendations to identify common method bias. We used principal component analysis, which resulted in a five-factor solution with eigenvalues above one, accounting for 62.706% of the total variance. The first component accounted for only 28.917%. Thirdly, we conducted a confirmatory factor analysis to investigate the common method bias. The results showed that the one-factor model fit was worse than the five-factor Model ($\chi 2 = 1546.727$, df = 147.000, x2/df = 10.522, RMSEA = 0.153, CFI = 0.645,

TLI = 0.587 and SRMR = 0.122), indicating that our study was not significantly impacted by common method bias.

4. Data analysis and results

Initially, we carried out basic descriptive statistical testing and correlation analysis utilizing SPSS 25. Next, we utilized Mplus 8.3 version, following Podsakoff *et al.* (2003) recommendations, to assess the convergent and discriminant validity of the constructs examined in this study. We utilized hierarchical regression analyses to evaluate the proposed hypotheses, the potential mediating roles of exploitative and exploratory GI, and the moderating effects of ROC.

Initially, we conducted Confirmatory Factor Analyses (CFA) to assess the reliability and validity of the constructs examined in our study. We utilized Mplus to determine whether the five-factor Model fit our data appropriately. The results showed that the five-factor Model provided the best fit for our hypothesized research model ($\chi 2$ = 407.161, df = 137.000, x2/df = 2.972, RMSEA = 0.069, CFI = 0.931, TLI = 0.914 and SRMR = 0.048), as indicated in Table 2 when compared to all other alternative models.

Furthermore, we assessed the reliability of the measurement model by calculating Cronbach's alpha and composite reliability to establish the stability of the Model. As depicted in Table 3, all five variables exhibited Cronbach's alpha and composite reliability values greater than the recommended threshold of 0.70, demonstrating satisfactory dependability. Secondly, convergent validity pertains to the extent to which factors designed to measure a single construct display consistency (John and Benet-Martínez, 2000). To evaluate convergent validity, we examined the factor loadings, which should be statistically significant and surpass 0.5 (Straub, 1989; Nunnally, 1978), and the average variance extracted (AVE), which should be greater than 0.5 for all constructs (Fornell and Larcker, 1981). Additionally, in our Model, GEO5, GP1, and GP6 had loadings below the proposed threshold (>0.5), and we excluded them from the final Model. The remaining factors displayed loadings exceeding 0.5, and the CR values were deemed acceptable and statistically significant at $p < 0.01$. The factor loadings ranged from 0.604 to 0.873, and all CR values were above 0.7. Moreover, the AVE values ranged from 0.539 to 0.645, indicating that our Model demonstrated satisfactory convergent validity. Table 3 provides the results for convergent validity.

Models	X2	Df	X2/Df	RMSEA	CFI	TLI	SRMR
Five factor model	407.161	137.000	2.972	0.069	0.931	0.914	0.048
Four factor model	1029.109	141.000	7.299	0.124	0.775	0.727	0.100
Three factor model	1130.233	144.000	7.849	0.129	0.750	0.703	0.102
Two factor model	1217.192	146.000	8.337	0.134	0.728	0.682	0.105
Common factor model	1546.727	147.000	10.522	0.153	0.645	0.587	0.122

Note(s): Five Factor model: Green entrepreneurial orientation, exploitative green innovation, Exploratory green innovation, green performance, resource orchestration capability
Four factor model: Green entrepreneurial orientation, exploitative green innovation + Exploratory green innovation, green performance, resource orchestration capability
Three factor model: Green entrepreneurial orientation + exploitative green innovation + Exploratory green innovation, green performance, resource orchestration capability
Two factor model: Green entrepreneurial orientation + exploitative green innovation + Exploratory green innovation + green performance, resource orchestration capability
Common factor model: Green entrepreneurial orientation + exploitative green innovation + Exploratory green innovation + green performance + resource orchestration capability
Source(s): Created by author

Table 2. Confirmatory factor analysis

Constructs/Items		Estimate	CR.	AVE.	Cα
Green entrepreneurial orientation			0.843	0.574	0.840
GEO1	When facing with uncertainty, we have an aggressive attitude towards green projects	0.836			
GEO2	We attach great importance to green research and development and green technology innovation	0.641			
GEO3	Our company has a tendency to become market leader and always takes the lead in introducing green products, services or technologies	0.757			
GEO4	We usually start green initiatives before our competitors	0.735			
GEO5	Our company has the attitude to "beat their competitors"	Deleted			
Exploitative green innovation			0.879	0.645	0.874
EGI1	Our firm actively improves current green products, processes	0.819			
EGI2	Our firm actively adjusts current green products, processes and services	0.793			
EGI3	Our firm actively strengthens current green market	0.727			
EGI4	Our firm actively strengthens current green technology	0.803			
Exploratory green innovation			0.849	0.584	0.846
ERGI1	Our firm actively adopts new green products, processes and services	0.750			
ERGI2	Our firm actively exploits new green products, processes and services	0.705			
ERGI3	Our firm actively discovers new green market	0.820			
ERGI4	Our firm actively enters new green technology	0.777			
Green performance			0.822	0.539	0.818
GP1	Our firm conforms with requirements of inputs of energy	Deleted			
GP2	Our firm conforms with requirements of outputs of air emissions	0.873			
GP3	Our firm conforms with requirements of indicators providing information on the local, regional, or national condition of the environment	0.657			
GP4	Our firm conforms with requirements of outputs of waste water	0.604			
GP5	Our firm conforms with expectations of implementation of environmental policies and programs	0.637			
GP6	Our firm has achieved important environment-related certifications (e.g. ISO 14031)	Deleted			
Resource orchestration capability			0.777	0.538	0.776
ROC1	our firm has capability to absorb all kinds of knowledge resources	0.693			
ROC2	our firm has capability to integrate all kinds of knowledge resources	0.767			
ROC3	our firm has capability to utilize all kinds of knowledge resources	0.738			

Source(s): Created by author

Table 3.
Reliability and validity results

In addition, we assessed the discriminant validity of the measures by computing the square root of AVE (see to Table 4 for this). The degree to which components meant for evaluating a given variables do not predict conceptually distinct criteria is called discriminant validity (John and Benet-Martínez, 2000). To examine discriminant validity, we employed Fornell and Larcker's method (Fornell and Larcker, 1981). According to this method, the AVE for each construct should be greater than the squared correlation with any other constructs (Fornell and Larcker, 1981). According to Table 4, the measurement model demonstrated adequate discriminant validity.

4.1 Descriptive statistics and correlations

Table 4 shows the descriptive statistics for the variables. According to the findings, the mean of ERGI (4.191) is greater than the mean of other variables, indicating that the sampled firms recognize ERGI more. GEO has a mean of 4.080, EGI has a mean of 4.128, while GP and ROC have average scores of 3.756 and 4.015, respectively. Moreover, the correlation matrix findings indicate that GEO, EGI, and ERGI are positively and strongly linked with GP. Similarly, ROC has a strong and favorable relationship with ERGI (see Table 4).

4.2 Hypotheses results

4.2.1 Direct and mediating effects. Hierarchical regression analysis was used to examine the hypotheses, as shown in Tables 5 and 6. Regressing the control variables against the dependent GP was performed in Model 9 of the hierarchical regression analysis. The control variable explained 0.02% of the variation in GP, with negligible effects from firm size ($\beta = 0.010$, n.s), and firm age ($\beta = 0.007$, n.s). In model 10, we examine the impact of the independent variable GEO on GP to test Hypothesis H1. The findings indicate that GEO substantially impacted GP ($\beta = 0.703$, p 0.001), verifying hypothesis H1.

Hypotheses H2aand H2b proposed that exploitative and exploratory GI mediate GEO and firm GP associations. We investigated the mediating impact in four phases, as suggested by Baron and Kenny (1986).

First: the independent variable (GEO) should be positively and significantly related to the dependent variable (GP). Model 10 (Table 6) demonstrated that GEO was significantly and positively associated with firm GP ($\beta = 0.703$, $p < 0.001$).

Second: The independent variable (GEO) must be significantly associated with the mediators (exploitative and exploratory GI). Table 5 shows that GEO positively affects exploitative GI (Model 2; $\beta = 0.744$, $p < 0.001$). Similarly, results are shown in Table 5 that GEO also has a positive effect on exploratory GI (Model 6; $\beta = 0.300$, $p < 0.001$).

Third: the mediators (exploitative and exploratory GI) should also be significantly linked to the dependent variable (GP). Results confirm in Table 6, that exploitative GI positively affects GP (Model 1; $\beta = 0.687$, $p < 0.001$). Similarly, results in Table 6 also reveal that exploratory GI positively affects GP (Model 13; $\beta = 0.484$, $p < 0.001$).

Fourth, the previously significant impact of the independent variable (GEO) on the dependent variable (firm GP) should either be insignificant or become diminished when the mediator (exploitative and exploratory GI) is added to the first step. When (exploitative and exploratory GI) were separately added to the regression equation, the influence of GEO on GP (for exploitatiavtive GI: Model 12; $\beta = 0.448$, $p < 0.001$) (for exploratory GI: Model 14; $\beta = 0.387$, $p < 0.001$) are still significant. Meanwhile, exploitative (Model 12: $\beta = 0.342$, $p < 0.001$) and exploratory GI (Model 14: $\beta = 0.218$, $p < 0.001$) are still positively related to GP, but the coefficients for both of the relationships are decreased. Following the suggestions of

Constructs	Mean	Std. Dev	Firms size	Age	GEO	EGI	ERGI	GP	ROC
Firm size	2.540	1.128	1						
Age	2.496	1.127	−0.026	1					
GEO	4.080	0.731	−0.002	0.061	*0.757*				
EGI	4.128	0.780	−0.016	0.030	0.758**	*0.803*			
ERGI	4.191	0.691	−0.044	0.015	0.351**	0.279**	*0.764*		
GP	3.756	0.635	0.019	0.011	0.739**	0.710**	0.435**	*0.734*	
ROC	4.015	0.866	0.046	−0.114*	0.054	0.007	0.229**	−0.022	*0.740*

Table 4.
Correlations

Source(s): Created by author

Table 5. Hierarchical regression analysis

Variables	Exploitative green innovation				Exploratory green innovation			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Constant	−0.147	0.013	0.018	0.025	−0.002	0.062	0.034	0.033
	(0.137)	(0.090)	(0.090)	(0.089)	(0.119)	(0.112)	(0.110)	(0.110)
Control variables								
Size	−0.011	−0.009	−0.008	−0.013	−0.023	−0.022	−0.027	−0.026
	(0.029)	(0.019)	(0.019)	(0.019)	(0.026)	(0.024)	(0.023)	(0.023)
Age	0.019	−0.009	−0.011	−0.013	0.008	−0.004	0.009	0.010
	(0.029)	(0.019)	(0.019)	(0.019)	(0.026)	(0.024)	(0.024)	(0.024)
Independent variable								
GEO		0.744***	0.747***	0.756***		0.300***	0.288***	0.287***
		(0.032)	(0.032)	(0.032)		(0.040)	(0.039)	(0.039)
Moderator								
ROC			−0.036	−0.020			0.193***	0.190***
			(0.034)	(0.033)			(0.041)	(0.042)
Interaction								
GEOxROC				0.077***				−0.014
				(0.021)				(0.026)
F value	0.955	137.184***	110.013***	96.797***	0.401	14.493***	16.631***	13.886***
R^2	0.007	0.576	0.577	0.591	0.003	0.125	0.171	0.172
ΔR^2	0.007	0.569	0.001	0.014	0.003	0.123	0.046	0.001

Source(s): Created by author

Table 6.
Hierarchical regression analysis results

Green performance Variables	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14	Model 15	Model 16	Model 17
Constant	−0.112	0.039	−0.011	0.034	−0.111	0.021	0.034	0.029	0.029
	(0.133)	(0.090)	(0.094)	(0.084)	(0.120)	(0.081)	(0.080)	(0.080)	(0.080)
Control variables									
Size	0.010	0.011	0.017	0.015	0.021	0.019	0.023	0.022	0.022
	(0.028)	(0.019)	(0.020)	(0.018)	(0.026)	(0.017)	(0.017)	(0.017)	(0.017)
Age	0.007	−0.020	−0.006	−0.017	0.004	−0.016	−0.023	−0.021	−0.021
	(0.028)	(0.019)	(0.020)	(0.018)	(0.026)	(0.017)	(0.017)	(0.017)	(0.017)
Independent variable									
GEO		0.703***		0.448***		0.387***	0.391***	0.387***	0.390***
		(0.032)		(0.046)		(0.045)	(0.045)	(0.044)	(0.045)
Mediator									
EGI			0.687***	0.342***			0.328***	0.330***	0.327***
			(0.034)	(0.047)			(0.044)	(0.044)	(0.045)
ERGI					0.484***	0.218***	0.246***	0.239***	0.242***
					(0.050)	(0.036)	(0.036)	(0.036)	(0.037)
Moderator									
ROC							−0.103	−0.010	−0.099
							(0.031)	(0.031)	(0.031)
Interaction									
EGIxROC								0.051*	0.050*
								(0.024)	(0.024)
ERGIxROC									0.006
									(0.017)
F value	0.320	122.005***	103.436***	121.138***	23.926***	116.163***	103.696***	92.135***	81.736***
R^2	0.002	0.547	0.506	0.600	0.192	0.634	0.644	0.648	0.648
ΔR^2	0.002	0.545	0.504	0.053	0.189	0.034	0.010	0.004	0.000

Source(s): Created by author

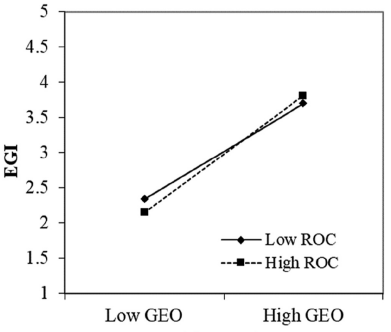
Baron and Kenny (1986), we established that exploitative and exploratory GI partly moderate the link between GEO and firm GP, providing empirical support to Hypotheses H2a and H2b. These findings showed that GEO could boost a firm's GP by stimulating exploitative and exploratory GI.

4.2.2 Moderating effects. We mean-centered the key variables before testing the interaction effects to evaluate the moderation effect and reduce probable multicollinearity. The variable variance inflation factor values were all <5.00, suggesting multicollinearity was not severe. Table 5 and Table 6 provide the regression results.

H3a and H3b proposed that ROC strengthens the effect of GEO on exploitative and exploratory GI. The result in Model 4 from Table 5 suggests that the impact of the interaction term between GEO and ROC is positive and significant on exploitative GI ($\beta = 0.077$, $p > 0.001$). Thus, the results support the H3a. The plot of the GEOxROC interaction (Figure 2) indicates that while ROC is higher, the positive effect of GEO on exploitative GI is more robust. Moreover, H3b proposed that ROC strengthens the effect of GEO on exploratory GI. Model 8 from Table 5 indicates that the impact of the interaction term between GEO and ROC is negative and insignificant ($\beta = -0.014$, $p > 0.05$). Thus, the result does not support H3b.

Hypotheses H4a and H4b proposed that ROC strengthens the effect of exploitative and exploratory GI on firm GP. The Model, 16 from Table 6 suggests that the interaction term between exploitative GI and ROC is positive and significant on the firm's GP ($\beta = 0.051$, $p > 0.001$). Thus, the results support H4a. The plot of the exploitative GIxROC interaction (Figure 3) indicates that when ROC is higher, the positive effect of exploitative GI on GP is stronger. Moreover, for H4b, the Model 16 from Table 6 suggests that the impact of the interaction term between exploratory GI and ROC is positive and insignificant ($\beta = 0.006$, $p > 0.05$). Thus, the result does not support H3b.

4.2.3 Moderated mediation. The results of moderated mediation relations are summarized in Table 7. The indirect association of GEO → EGI → GP was positively significant at the higher level of ROC ($\beta = 0.295$, $p < 0.01$), whereas at the lower level of ROC, the indirect association was also significant ($\beta = 0.094$, $p < 0.001$), and the difference between the higher and lower level of path coefficient is significant ($\Delta\beta = 0.202$, $p < 0.001$). As a result, H5a is supported. Similarly, for H5b, At the higher level of ROC, the indirect association of GEO → ERGI → GP was positively significant ($\beta = 0.057$, $p < 0.01$), whereas at the lower level of ROC, the indirect association was also significant ($\beta = 0.046$, $p < 0.01$) and the difference between higher and lower level of path coefficient is insignificant ($\Delta\beta = 0.011$, n.s). Hence H5b is not supported.



Source(s): Created by author

Figure 2.
GEOxROC on EGI

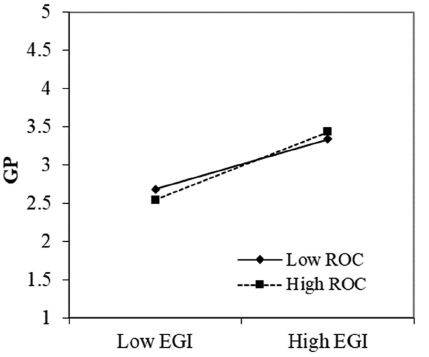


Figure 3.
EGIxROC on GP

Source(s): Created by author

Hypotheses	Conditional effects of ROC	Estimate	S.E.	*T*-value	*P*-value
Hypothesis 5a	*GEO → EGI → GP*				
	At a lower level of ROC	0.094	0.029	3.198	0.001
	At a higher level of ROC	0.295	0.053	5.606	0.000
	Difference	0.202	0.057	3.523	0.000
Hypothesis 5b	*GEO → ERGI → GP*				
	At a lower level of ROC	0.046	0.016	2.786	0.005
	At a higher level of ROC	0.057	0.021	2.728	0.006
	Difference	0.011	0.027	0.402	0.688

Table 7.
Moderated mediation results

Source(s): Created by author

5. Discussion and conclusion

This research investigates the association between GEO, ambidextrous GI (exploitative and exploratory GI), and GP. We explored how GEO, an intangible organizational resource, may influence ambidextrous GI (exploratory and exploitative GI) and GP, considering the RBV suggestion that different resource types can significantly impact a firm's performance (Jiang *et al.*, 2018). ROC is explored as a moderator in the interaction between GEO, ambidextrous GI, and GP in the context of organizational competencies. Additionally, researchers stressed the significance of enhancing company GP as one of the most strategic strategies for enterprises to acquire a long-term competitive advantage, sustainable development, and financial development (Shehzad *et al.*, 2023a; Abbas, 2020). Additionally, Úbeda-García *et al.* (2022) asserted that enhancing sustainable performance in the manufacturing industry is critical to gaining a competitive advantage and achieving long-term sustainability goals. As a result, this research has significantly expanded and increased the understanding of theoretical and practical endeavors in GEO, ambidextrous GI, and GP in several ways.

First, the findings indicate that GEO substantially improves a firm's GP through the promotion of eco-friendly practices within the manufacturing sector. This enhancement is attributed to reduced waste and energy consumption, fostering a culture dedicated to environmental conservation. Such practices not only augment customer satisfaction and loyalty but also distinguish the firm from competitors less committed to sustainability. This aligns with the NRBV perspective, emphasizing the strategic value of intangible resources in enhancing sustainable performance, a sentiment echoed by Shehzad *et al.* (2023a), Yusoff *et al.* (2019), and Wang and Juo (2021).

Second, in the realm of NRBV theory, existing studies primarily focus on the role of GEO in facilitating environmental information exploration and GI enhancement (Wang *et al.*, 2023; Shehzad *et al.*, 2023b). However, these studies often overlook the differentiation between types of GI—specifically, ambidextrous GI, which encompasses both exploitative and exploratory innovations (Shehzad *et al.*, 2023a). The literature is also sparse on how GEO interacts with these ambidextrous GIs to bolster Green Performance (GP). This gap led to the identification of ambidextrous GI as a mediating factor in the relationship between GEO and GP, with empirical evidence suggesting that GEO's impact on GP is partially mediated by both exploitative and exploratory GI. This implies that GEO directly influences GP and also does so indirectly by promoting firms' engagement in both types of GI. The degree of a firm's commitment to eco-friendly practices and sustainable business models can elucidate these findings. Firms with strong GEO are more inclined to focus on GI and invest in green technologies and processes. For firms with lower GEO, exploitative GI, which involves incremental changes, may be more feasible. In contrast, exploratory GI is better suited for firms with high GEO, aligning with their sustainability goals and providing a competitive edge. Therefore, firms should weigh the advantages and disadvantages of each GI strategy to identify the most fitting approach. Adopting sustainable practices, technologies, and products can help firms reduce their environmental footprint and secure a competitive advantage. The significance of organizational intangible resources like GEO in fostering ambidextrous GI and improving sustainable performance is further supported by the findings of Úbeda-García *et al.* (2022) and Frare and Beuren (2022).

Third, leveraging NRBV theory, this study probes the role of ROC in augmenting GI within the Manufacturing sector. Earlier inquiries highlighted ROC's potential to enhance GI outcomes, advocating for further exploration of its moderating effects on green organizational efficacy and innovation (Shehzad *et al.*, 2023b; Wang *et al.*, 2020b). Our analysis reveals that ROC positively influences the synergy between GEO and exploitative GI, indicating that firms with robust ROC are more adept at refining existing green practices for superior performance. However, ROC's influence appears negligible in the nexus between GEO and exploratory GI, suggesting that the benefits of radical green innovations do not necessarily escalate with higher ROC in manufacturing environments. This underscores that improved results for exploratory GIs in the manufacturing industry may not always follow from having a high ROC.

The findings confirm that ROC moderates between exploratory GI and GP but does not moderate the connection between exploratory GI and GP. In the case of the Manufacturing industry, the ROC may have moderated the link between exploitative green innovation (i.e. incremental improvements to current green practices) and GP in a positive and meaningful manner, suggesting that firms with greater levels of ROC are better able to transfer these innovations into enhanced environmental performance. The association between exploratory green innovation (i.e. more radical or innovative green practices) and GP in the Manufacturing industry does not seem to be affected comparably by this capacity. This may be because ROC alone may not be able to support deploying such novel practices because it may need more substantial organizational changes or investment. Other aspects, including management attitude, company culture, and stakeholder involvement, may also influence the link between exploratory green innovation and GP in the Manufacturing industry.

The research also looked at how ambidextrous GI (exploratory and exploratory GI) impacted GEO and GP at different levels of ROC. The results showed that a degree of ROC strengthens the connections between GEO, exploitative GI, and GP. This could be because businesses with greater ROC can better recognize, create, and incorporate new green practices into their current operations. This may therefore result in the GEO techniques being implemented more successfully and having a higher favorable impact on GP. Also,

businesses with higher levels of ROC could better adjust to changes in the market and regulatory landscapes connected to environmental sustainability, making it easier to execute and spread exploitative green technologies. Overall, our results imply that ROC may significantly impact how GEO, exploitative green innovation, and GP are related and that businesses with greater levels of ROC may be better positioned to take advantage of these links to gain a competitive edge in the market.

5.1 Theoretical contributions

This study extends our understanding of GEO, GP, ambidextrous GI, and ROC in the manufacturing industry. First, drawing from the NRBV, this study underscores the pivotal role of resources in enhancing organizational capabilities and securing a competitive edge, a concept widely endorsed yet insufficiently explored within the context of GP and their precursors (Usman Shehzad *et al.*, 2022; Mao *et al.*, 2016; Alam *et al.*, 2022). Despite the acknowledgment of GP as a crucial element in environmental management, the researchers dialogue remains nascent, with a scant body of literature addressing this domain (Abbas, 2020; Zhang *et al.*, 2019). Through the development of a comprehensive theoretical framework, this research elucidates the relationships among GEO, Ambidextrous GI, and ROC in shaping the GP of the manufacturing sector, thereby enriching the NRBV discourse.

Second, there hasn't been much discussion of the connection between GEO and GP in the literature. Most previous studies investigated the effect of GEO on firm environmental performance (Frare and Beuren, 2022; Makhloufi *et al.*, 2022; Jiang *et al.*, 2018) but did not specify how GEO influences GP, especially in the context of the Manufacturing industry. This research aimed to provide light on how GEO has direct effects on GP, expanding upon the work of Frare and Beuren (2022), Makhloufi *et al.* (2022), and Jiang *et al.* (2018).

Thirdly, this study advances the theoretical implications within the NRBV framework by dissecting the mediating influence of GI on the synergy between a firm's intangible assets and its performance metrics. Previous literature, including insights from Wang and Juo (2021) and Rehman *et al.* (2021), has not distinctly categorized GI into its exploitative and exploratory dimensions, leaving a gap in understanding its dual role. By delving into the nuanced roles of both exploitative and exploratory facets of ambidextrous GI, this research clarifies their separate contributions to enhancing GP. It underscores the pivotal mediation provided by ambidextrous GI, aligning with the NRBV's emphasis on leveraging unique resources for enhanced performance and competitive positioning. This elucidation not only clears the existing ambiguities around the multifaceted nature of GI but also builds upon the foundational insights provided by Frare and Beuren (2022), Makhloufi *et al.* (2022), and Jiang *et al.* (2018), suggesting a strategic pathway for firms to harness their intangible resources for sustainable competitive advantage through GP.

Finally, the earlier research suggests that ROC increases the connection between GI's antecedents and effects (Wang *et al.*, 2020b; Shehzad *et al.*, 2023b). By exploring the moderating function of ROC, which has previously received less attention from research, the current study has added to the conversation on the relationship between GEO, ambidextrous GI, and GP. Moreover, the moderated mediation effect demonstrates how GEO enhances GP and emphasizes the value of ambidextrous GI and ROC. Our findings build upon prior research, provide a more thorough explanation of ROC, and demonstrate the interaction of GEO, ambidextrous GI, and ROC to boost the GP of the manufacturing industry.

5.2 Practical contributions

The research offers several useful insights demonstrating the need for GEO as the fundamental mechanism for reaping the potential benefits of ambidextrous GI and GP in moving towards a greener environment. Firstly, manufacturing firms' management may

enhance their environmental performance in several ways by adopting a GEO: Encouraging GI through the adoption of GEO can lead management in manufacturing firms to explore innovative sustainability measures. They might investigate alternative energy sources, cut down on water usage, and adopt waste reduction techniques. By adopting GEO, manufacturing firms can also improve their brand image, appealing to eco-aware clients who are willing to pay more for eco-friendly products. GEO can lead to cost savings by using less energy and resources, which helps in reducing operational costs and boosting profitability over time. Additionally, with governments imposing regulations to encourage sustainability in manufacturing, firms adopting GEO can stay ahead of regulatory challenges, avoiding penalties or taxes for non-compliance.

The integration of GEO within the manufacturing sector significantly fosters ambidextrous GI, characterized by both exploitative and exploratory endeavors aimed at bolstering environmental sustainability. Exploitative strategies are tailored to refine existing processes and technologies, thereby minimizing waste, conserving financial resources, and safeguarding the environment. An illustration of this can be seen in manufacturing entities adopting GEO practices, which might include the deployment of energy-efficient lighting and appliances, the initiation of recycling programs, and the application of water conservation measures through the utilization of low-flow fixtures and xeriscaping. On the other side, exploratory efforts are directed towards the identification and development of novel products, services, and technologies that can further environmental sustainability goals. Examples of such initiatives include the exploration of renewable energy sources such as solar or wind power, the introduction of eco-friendly cleaning products, or the provision of sustainable transport solutions to consumers.

In conclusion, research supports the importance of ROC in fostering ambidextrous GI. The research underlined the relevance of the ROC to firm management and recommended that the ROC support GI in advancing sustainable development (Wang *et al.*, 2020b; Shehzad *et al.*, 2023b). Specifically, ROC is essential in boosting GP in the firm sector by interacting with GEO and ambidextrous GI. Particularly, businesses should consider enhancing their ROC to speed up exploitative GI. To support GI, for instance, businesses could encourage environmental entrepreneurship and legalize unofficial processes, enhancing ROC and increasing GP.

5.3 Study limitations

To properly evaluate the findings of this study, some limitations must be considered. These limitations also provide potential research opportunities. First, the findings of this study cannot be generalized to other sectors or cultural settings since it was conducted in a specific national context, namely the manufacturing sector in the UAE. As a consequence, generalizing the findings should be done with care. Second, as the manufacturing sector comprises various industries with varying levels of environmental impact (Shehzad *et al.*, 2023a), it is crucial that future research distinguishes between them. Conducting a comparative study between these firms could offer valuable evidence to address the uncertainty surrounding their environmental impact. Third, the data on the used measures, however, were gathered at a single moment in time. The current research considers the mediation of ambidextrous GI in relating GEO to GP. This association should be investigated in more detail using a longitudinal approach in future studies. Fourth, the present research exclusively focused on GP as the outcome variable. Future research may also examine the triple bottom line or the performance of an organization on all three axes: social, economic, and environmental. Lastly, we investigate the moderating effects of organizational capacity; however, our empirical investigation is limited to a single capability ROC. Also, earlier research highlighted the importance of supporting several organizational capacities,

including absorptive, combinative, and green capabilities (Shehzad *et al.*, 2023b; Huang *et al.*, 2016). Thus, these traits must be acknowledged and objectively investigated in the following study.

5.4 Final remarks

This study demonstrates the significant impact of GEO on green performance, with ambidextrous GI acting as a crucial mediator. It reveals that both exploratory and exploitative GI mediate the relationship between GEO and green performance, emphasizing the importance of green innovation strategies. The research additionally shows that ROC strengthens the connection between GEO and ambidextrous GI and amplifies the mediating role of exploitative ambidextrous GI in improving green performance. From a practical perspective, the findings offer insights for manufacturing firms, suggesting that adopting green entrepreneurship practices can lead to reduced environmental impact and sustainable performance. The study highlights the role of ambidextrous GI and the importance of ROC in maximizing the benefits of GEO for green performance, and advances theoretical discussions on green entrepreneurship, setting a foundation for future research on sustainable practices within the context of green entrepreneurship.

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